

Study Guide

For use with pages 464–469

GOAL Use the Pythagorean theorem to solve problems.**VOCABULARY**

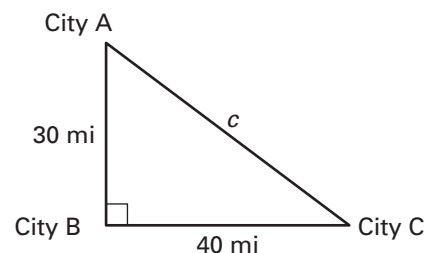
In a right triangle, the **hypotenuse** is the side opposite the right angle. The **legs** are the sides that form the right angle. The lengths of the legs and the length of the hypotenuse of a right triangle are related by the **Pythagorean theorem**, which states that for any right triangle, the sum of the squares of the lengths of the legs equals the square of the length of the hypotenuse.

EXAMPLE 1 Finding the Length of a Hypotenuse

City A is 30 miles due north of City B. City C is 40 miles due east of City B. Find the distance c between City A and City C.

Solution

To find the distance between the cities, picture a right triangle connecting the cities.



$$a^2 + b^2 = c^2 \quad \text{Pythagorean theorem}$$

$$30^2 + 40^2 = c^2 \quad \text{Substitute 30 for } a \text{ and 40 for } b.$$

$$900 + 1600 = c^2 \quad \text{Evaluate powers.}$$

$$2500 = c^2 \quad \text{Add.}$$

$$\sqrt{2500} = c \quad \text{Take positive square root of each side.}$$

$$50 = c \quad \text{Evaluate square root.}$$

Answer: The distance between City A and City C is 50 miles.

EXAMPLE 2 Finding the Length of a Leg

Find the unknown length b in simplest form.

Solution

$$a^2 + b^2 = c^2 \quad \text{Pythagorean theorem}$$

$$6^2 + b^2 = 14^2 \quad \text{Substitute.}$$

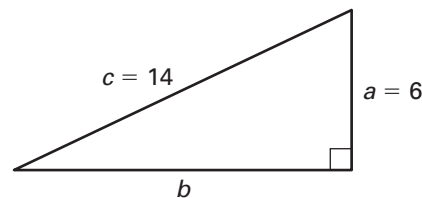
$$36 + b^2 = 196 \quad \text{Evaluate powers.}$$

$$b^2 = 160 \quad \text{Subtract 36 from each side.}$$

$$b = \sqrt{160} \quad \text{Take positive square root of each side.}$$

$$b = 4\sqrt{10} \quad \text{Simplify.}$$

Answer: The unknown length b is $4\sqrt{10}$ units.



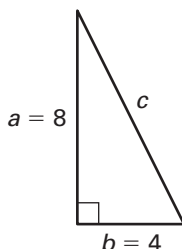
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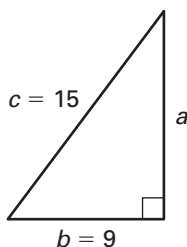
Exercises for Examples 1 and 2

Find the unknown length. Write your answer in simplest form.

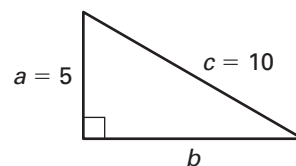
1.



2.



3.

**EXAMPLE 3 Identifying Right Triangles**

Determine whether the triangle with the given side lengths is a right triangle.

a. $a = 8, b = 6, c = 12$

b. $a = 3, b = 4, c = 5$

Solution

a. $a^2 + b^2 = c^2$

$8^2 + 6^2 \stackrel{?}{=} 12^2$

$64 + 36 \stackrel{?}{=} 144$

$100 \neq 144$

Answer: Not a right triangle

b. $a^2 + b^2 = c^2$

$3^2 + 4^2 \stackrel{?}{=} 5^2$

$9 + 16 \stackrel{?}{=} 25$

$25 = 25 \checkmark$

Answer: A right triangle**Exercises for Example 3**

Determine whether the triangle with the given side lengths is a right triangle.

4. $a = 12, b = 5, c = 13$

5. $a = 3, b = 9, c = 11$

6. $a = 6, b = 11, c = 12$